Oxford Cambridge and RSA

OCR-set Assignment

Sample Assessment Material

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering

Unit F136: Computer Aided Manufacture (CAM)

Scenario Title: Stepper motor mount bracket **OR** Hose barb fitting

Valid for assessment from September 20XX to 20XX.
For use by students beginning the qualification in September 20XX.

This is a sample OCR-set assignment which should only be used for practice**.**

This assignment **must not** be used for live assessment of students.

The live assignments will be available on our secure website, 'Teach Cambridge'.

The OCR administrative codes linked to this unit are:

- unit entry code F136
- certification code H127

The regulated qualification number linked to this unit is:

H/651/0639

Duration

About 18 hours of supervised time (GLH)
(work that **must** be completed under teacher supervised conditions)

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purposes of assessment.

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Information and instructions for Teachers

Using this assignment

This assignment provides a scenario and set of related tasks that reflect how engineering companies might produce pre-production components to be evaluated by a client.

You can give this to students on or after 1 June 20XX to help them understand it before they start using it for assessment. The dates for which students can use it for assessment are shown on the front cover.

The assignment:

- Is written so that students have the opportunity to meet the requirements of all assessment criteria for the unit.
- Will tell students if their evidence must be in a specific format. If the task does not specify a format, students can choose the format to use.
- **Must** be completed under teacher supervision. Any unsupervised time allowed will be explained in the assessment guidance.
- We have estimated that this assignment will take about 18 hours of supervised time to complete.
  Students should need approximately:
  - 2 hours to complete Task 1
  - 5 hours to complete Task 2
  - 6 hours to complete Task 3
  - 3 hours to complete Task 4
  - 2 hours to complete Task 5

You **must**:

- Use an OCR-set assignment for summative assessment of students.
- Familiarise yourself with the assessment criteria and assessment guidance for the tasks. These are given at the end of each student task. They are also with the unit content in **Section 5** of the Specification.
  Assessment guidance is only given where additional information is needed. There might not be assessment guidance for each criterion.
- Make sure students understand that the assessment criteria and assessment guidance tell them in detail what they need to do in each task.
- Read and understand **all** the rules and guidance in **Section 7** of the Specification **before** your students start the set assignments.
- Make sure that your students complete the tasks and that you assess

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the task fully in line with the rules and guidance in **Section 7** of the Specification.

- Make students aware of all relevant health and safety considerations before starting any practical work.
- Make sure that students are appropriately supervised during any practical work and are working safely.

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- Intervene during practical work if necessary to ensure students' safety. In such instances, staff should assist the student to ensure their safety and so that they can continue with the subsequent assessment tasks, but they cannot be credited for the criteria directly addressing the practical skills where they have had to be helped unless the assessment guidance states otherwise.

- Give your students the engineering **Student guide to NEA assignments before** they start the assignments.
- Complete the **Teacher Observation Record** for **Task 3 and Task 4**. You **must** follow the guidance given when completing it.

You **must not**:

- Use live OCR-set assignments for practice or formative assessment. This sample assessment material **can** be used for practice or formative assessment.
- Use this sample assessment material for live assessment of students.
- Allow group work for **any** task in this assignment.
- Change any part of the OCR-set assignments or assessment criteria.
-

Information for delivering tasks

Task	Requirements
All	• Only **one** of the two components listed has to be made. This is to enable centres greater flexibility when delivering this unit in terms of the machinery they have available (e.g. CNC milling machine or CNC lathe). Students can make both components if they wish but only one will be assessed.

Pages 1-4 are for teachers only. Please do **not** give **Pages 1-4** to your students.

You can give **any** or **all** of the pages **that follow** to your students.

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Tasks for students and assessment criteria

Unit F136: Computer Aided Manufacture (CAM)

Scenario Title: Stepper motor mount bracket OR Hose barb fitting

Valid for assessment from September 20XX to 20XX.

For use by students beginning the qualification in September 20XX.

Scenario

You are an engineer with Cambridge Engineering, a small manufacturing company.

A client wants to investigate the use of both additive and subtractive CAM processes to manufacture prototypes of some new components.

Your supervisor has asked you to choose either Component A or Component B to work with.

The client has placed an order to manufacture two versions of one prototype component using two different Computer Aided Manufacturing (CAM) processes.

The component to be manufactured is **either**:

- Component **A**: a stepper motor mount bracket, **OR**
- Component **B**: a hose barb fitting.

An orthographic engineering drawing of Component A and Component B is given in Appendix A. For both components:

- the client has specified four functional dimensions (shown in **bold** text) that **must** be kept
- other remaining dimensions can be adapted as part of the design for manufacturing process and/or you will need to decide upon yourself.

Before you choose one component to manufacture please read all the tasks.

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Task 1:
Subtractive and additive Computer Aided Manufacturing (CAM) processes

Topic Area 1 is assessed in this task.

Choose **one** of the components from the scenario.

The client has asked how this component could be manufactured commercially using a subtractive and an additive CAM process. The client wants to order 10,000 metal components.

As it is for **commercial** manufacture you should consider the most appropriate processes, not just the ones available in your centre.

The task is:

To investigate subtractive and additive processes for manufacturing the component commercially taking into account:

- how the component will be safely manufactured
- sustainability
- the order volume.

Your evidence **must** include:

- A written report

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P1: Describe how the component can be manufactured using subtractive CAM processes. (PO2)	**M1: Explain** what sustainability considerations should be applied in the manufacture of the component using subtractive and additive CAM processes. (PO2)	**D1: Evaluate** the suitability of subtractive and additive CAM processes to manufacture the component. (PO3)
P2: Describe how the component can be manufactured using additive CAM processes. (PO2)		

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P1	• Students must cover more than one subtractive process for commercial manufacture. • Students could consider using images to support their descriptions of the processes.
P2	• Students must cover more than one additive process for commercial manufacture. • Students could consider using images to support their descriptions of the processes.
D1	• Students must consider the advantages and disadvantages of subtractive and additive processes for the component chosen and the order volume. They need to make a recommendation about the best subtractive process to use and the best additive process to use.

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Task 2:
Produce three dimensional (3D) Computer Aided Design (CAD) models of a component

Topic Area 2 is assessed in this task.

You do **not** need to use the same component selected in Task 1.

The client would like to see some CAD models of prototypes for **one** of the components and how these might differ for subtractive and additive manufacturing.

In this task you will produce 3D CAD models of your chosen component to use in Tasks 3 and 4.

You **must** retain the functional dimensions specified by the client, as shown in **bold** text on the engineering drawing. Other remaining dimensions can be adapted as part of the design for manufacturing process and/or you will need to decide upon yourself.

The task is:

To produce 3D CAD models for the prototype component which retain the functional dimensions specified by the client and can be used for subtractive and additive manufacturing.

Your evidence **must** include:

- Annotated screen shots of the 3D CAD models
- Annotations and/or notes of any adaptations made for manufacturing.

Use the assessment criteria below to tell you what you need to do in more detail.

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td rowspan="2">P3: Produce an accurate 3D CAD model of the prototype component from the given engineering drawing.
(PO4)</td><td>M2: Adapt the 3D CAD model showing appropriate consideration of DFSM.
(PO4)</td><td rowspan="2">D2: Justify the DFSM and DFAM adaptations to the 3D CAD models of the prototype component.
(PO3)</td></tr>
<tr><td>M3: Adapt the 3D CAD model showing appropriate consideration of DFAM.
(PO4)</td></tr>
</table>

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P3	• Students need to produce an initial 3D model which reflects the engineering drawing given and retains the functional dimensions specified by the client.
M2	• Students must adapt the 3D model from P3 to make it suitable for subtractive manufacturing with reference to Topic Area 2.2.
M3	• Students must adapt the 3D model from P3 to make it suitable for subtractive manufacturing with reference to Topic Area 2.2.
D2	• Students must give valid reasons for how the adaptations made in M2 and M3 make the design more suitable for each manufacturing process.

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Task 3:
Manufacture a component using a subtractive process

Topic Area 3 is assessed in this task.

The client now wants to see some manufactured prototypes of your chosen component produced using both a subtractive and an additive process.

You will first need to write a production plan for the manufacture of the component you modelled in Task 2 using a subtractive process. You then need to use the production plan to complete the manufacture of the prototype component.

As these are prototypes they can be made from any suitable metal or polymer.

The task is:

To plan for and safely complete the manufacture of a prototype of your chosen component using a subtractive process, including importing your 3D CAD model from Task 2 into the CNC machine and simulating the program.

Your evidence **must** include:

- A written production plan
- Annotated screen shots of the simulation
- Annotated photographs of you safely using the CNC machine
- Photographs of the completed prototype component
- A teacher observation record completed by your teacher/assessor which accurately records your independence and competence when setting up, using and shutting down the machine.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P4: Produce a production plan for the manufacture of the prototype component using a CNC subtractive process. (PO4)		
P5: Import the model and simulate the program. (PO4)	**M4: Interpret** simulation results and make appropriate improvements. (PO3)	
P6: Operate and shut down a CNC machine safely for the subtractive manufacture of the prototype component. (PO4)	**M5: Set up** a CNC machine safely, appropriately and independently. (PO4)	**D3: Justify** the machine settings used. (PO3)

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P4	• The plan must reflect Topic Area 3.2.1.
P5	• Students must be able to import and run the simulation to check for errors.
M4	• Students must make suggestions for improvements to the program rather than the CAD model at this stage. • Students could make notes about any potential improvements which could be made to the CAD model in readiness for Task 5. • If there are no improvements to make based on the simulation results, students must explain these results to achieve M4 (rather than suggest unnecessary improvements) • Teacher/technician support is allowed to ensure that a working model is available so that subsequent tasks and criteria can still be achieved. **Where this support is needed M4 cannot be awarded.**
P6	• Students can still achieve this criterion even if some support is needed from staff, as long as the student is able to operate and shut down the machine safely with support and/or guidance.
M5	• Students must have been able to operate in a safe and appropriate way **independently** without any support or intervention from staff to achieve this. Staff must intervene if safe working practices are not being followed but where this happens the criteria cannot be awarded as achieved.
D3	• Students must give valid reasons for the machine settings used and why they were chosen. • This criterion could be evidenced within the simulation results or as separate written notes with screen shots of the settings.

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Task 4:
Manufacture a component using an additive process

Topic Area 4 is assessed in this task.

You now need to write a production plan for the manufacture of the component you modelled in Task 2 using an additive process. You then need to use the production plan to complete the manufacture of the prototype component.

As these are prototypes they can be made from any suitable metal or polymer.

The task is:

To plan for and safely complete the manufacture of a prototype of your chosen component using an additive process, including importing your 3D CAD model from Task 2 into the additive manufacturing machine and completing any finishing operations.

Your evidence **must** include:

- A written report including screen shots and annotated photographs
- Screen shots of the simulation
- Photographs of you safely using the CNC machine
- Photographs of the completed component
- A teacher observation record completed by your teacher/assessor which accurately records your independence and competence when setting up, using and shutting down the machine

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P7: Produce a production plan for the manufacture of the prototype component using an additive manufacturing process. (PO4)		**D4: Justify** the machine settings used. (PO3)
P8: Manufacture the prototype component safely using the additive manufacturing machine, including set up, operation and shut down. (PO4)		**D4:** Justify the machine settings used (PO3)
P9: Complete prototype component removal and finishing operations.		

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(PO4)		

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P7	• The plan must reflect Topic Area 4.1. • Production planning must include any simulation undertaken and alterations made in preparation for a successful additive manufacturing process.
P8	• Students must be able to perform the task safely to achieve this criterion. Staff must intervene if safe working practices are not being followed but where this happens the criteria cannot be awarded as achieved.
D4	• Students must give valid reasons for the machine settings used and why they were chosen. • This criterion could be evidenced within the production plan, as separate written notes, or as part of the annotated photographs of the manufacturing process.
P9	• Students must use relevant finishing operations for the additive process used to produce the final prototype.

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Task 5:
Evaluating components manufactured using subtractive and additive manufacturing processes

Topic Area 5 is assessed in this task.

The client has asked for your assessment of the prototypes produced using both a subtractive and an additive process and how well the processes worked for the prototype components.

The task is:

To analyse the two prototype components manufactured in Task 3 and Task 4.

Your evidence **must** include:

- A written report including:
  - Photographs of you measuring the components using appropriate equipment
  - Tabulated records of the measured dimensions
  - Written quantitative evaluation of the manufactured components' dimensions compared with the intended dimensions
  - Any analysis of processes and recommendations.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P10: Measure accurately the functional dimensions of the two manufactured prototype components using appropriate measuring equipment. (PO4)	**M6: Analyse** the effectiveness of DFSM and DFAM applied to manufacture the prototype components. (PO3)	**D5: Recommend** improvements to the drawings and manufacturing processes for each component you manufactured. (PO3)
P11: Determine whether the functional dimensions of each prototype component are within tolerance. (PO2)		

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P10	• Equipment is 'appropriate' if it enables an accurate measurement to be taken for the product and dimension in question.
P11	• If students' measurements (P10) lack accuracy but the actual prototype is within tolerances P11 can be awarded based on the teachers measurements of the prototype. • Conversely, P11 is **not** achieved if the students' measurements are within tolerances but the measurements are inaccurate.
M6	• Students need to analyse what worked well and where there were issues with their DFSM (M2) and DFAM (M3) adaptations (Task 2) in relation to the prototypes produced.
D5	• For D5 students must make recommendations which cover both drawings and manufacturing processes. • 'Drawings' can be related back to the original 3D CAD model (P3), and/or to adaptations in M2 and M3. • Manufacturing processes can include any aspects of the production planning or manufacture of the prototypes, including set up and settings.

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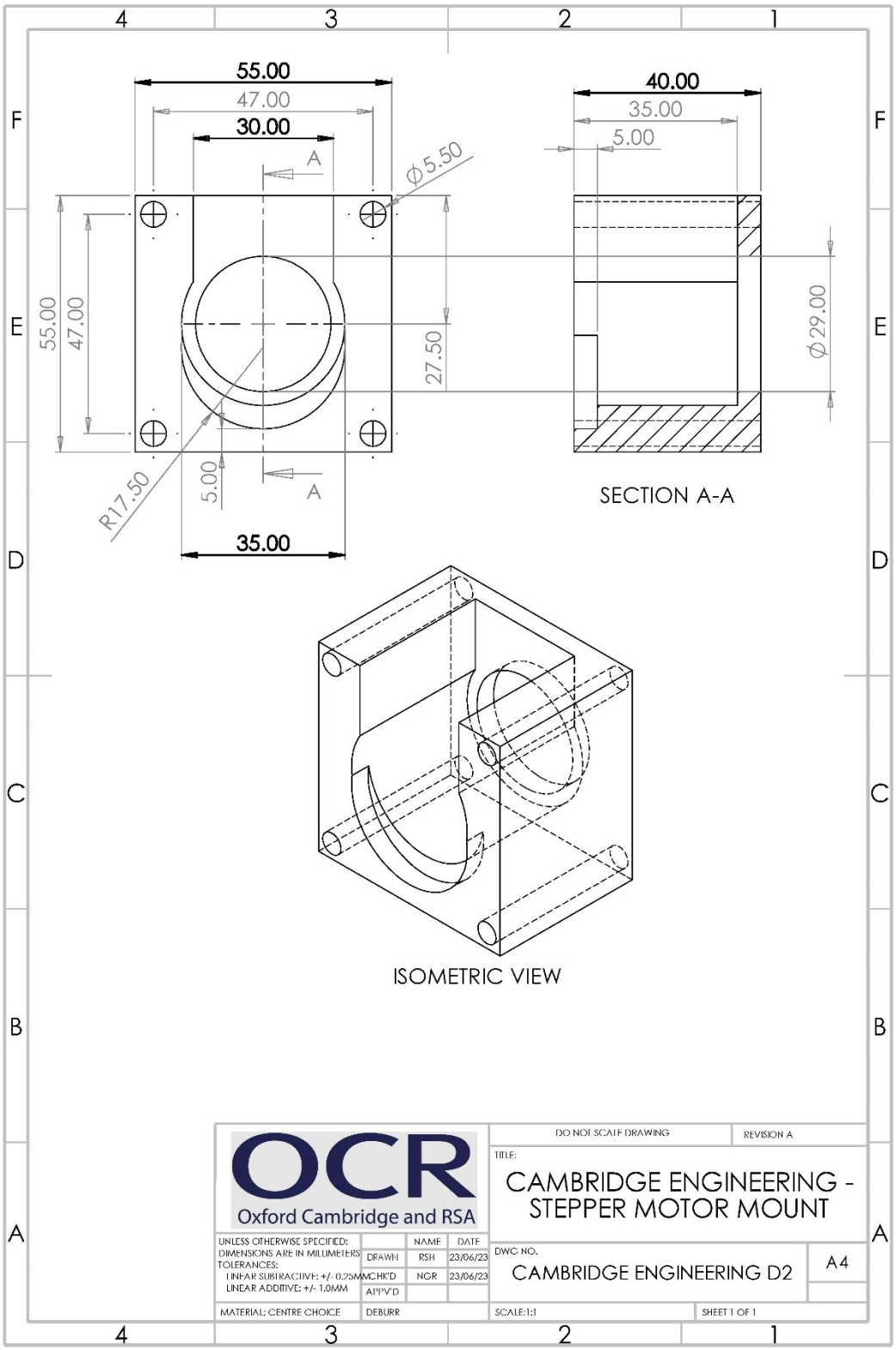
Appendix A

Stepper Motor Mount Bracket – Functional dimensions are shown in **bold**.



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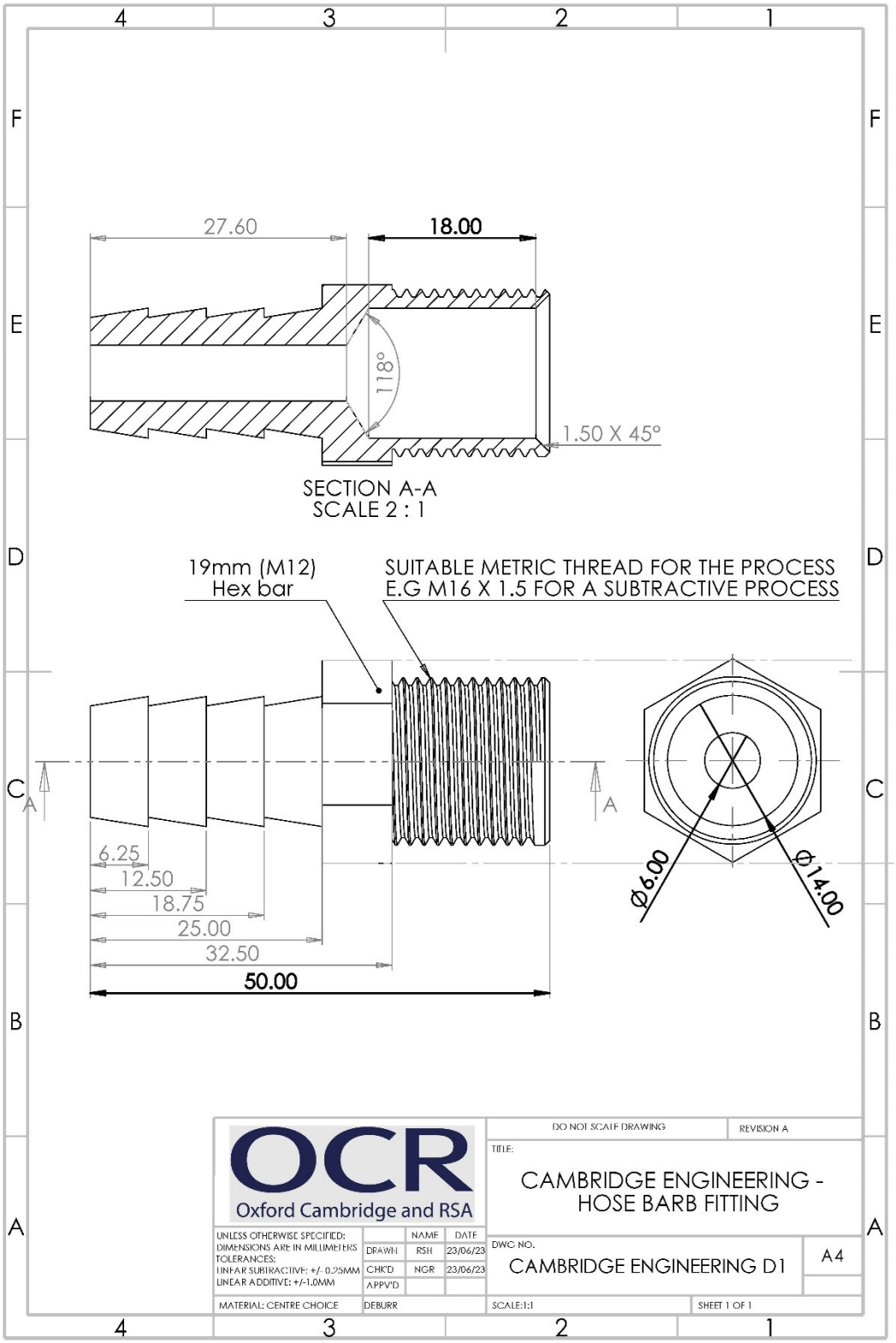
Hose Barb Fitting - Functional dimensions are shown in **bold**.



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Teacher Observation Record Form – Task 3

Use this form to record what is observed.
Read the **guidance notes** below the form **before** you complete the form.

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering (Extended Certificate)

Unit number:	F136
Unit title:	Computer Aided Manufacture (CAM)
Task number:	3
Task title:	Manufacture a component using a subtractive process

Student's name:	
Date the activity was completed:	

What extra evidence is attached to the form?	

The **teacher** fills in this section:

What Assessment Criteria does this activity relate to?	
How does the activity meet the requirements of the Assessment Criteria? You **must** describe: 1. what the student did 2. how it relates to the relevant Assessment Criteria	
Teacher's name:	

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Teacher's signature:	
Date:	

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The **student** fills in this section:

I agree with my teacher's description of how I completed this activity Yes ☐	
Use this space to make any extra comments.	
Student's signature:	
Date:	

Guidance notes

Both the teacher **and** the student are responsible for completing this form.

The **teacher must**:
- use the form to describe in detail what they observed the student doing.
- give contextualised details of what the student did and how this relates to the Assessment Criteria.
- say how well the activity was completed in relation to the Assessment Criteria with reasons.
- share what they have written with the student and offer the opportunity to discuss if the student disagrees with what is written.
- reach agreement with the student before the work is submitted for moderation.
- sign and date the form as evidence of agreement.

The **student must**:
- reach agreement with the teacher before the work is submitted for moderation.
- use the form to show that they agree with the teacher's record of the activity observed
- sign and date the form as evidence of agreement.

The form **must**:
- be accompanied by extra evidence, as required by the task.
- provide evidence that is individual to the student.

The form **must not**:
- contain a simple repeat of the Assessment Criteria.
- contain just a list of skills.
- be completed by anyone other than the teacher observing the activity and the student completing the activity.
- be written by the student for the teacher to sign.
- be used to evidence achievement of a whole unit or task in isolation.

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Teacher Observation Record Form – Task 4

Use this form to record what is observed.
Read the **guidance notes** below the form **before** you complete the form.

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering (Extended Certificate)

Unit number:	F136
Unit title:	Computer Aided Manufacture (CAM)
Task number:	4
Task title:	Manufacture a component using an additive process

Student's name:	
Date the activity was completed:	

What extra evidence is attached to the form?	

The **teacher** fills in this section:

What Assessment Criteria does this activity relate to?	
How does the activity meet the requirements of the Assessment Criteria? You **must** describe: 1. what the student did 2. how it relates to the relevant Assessment Criteria	
Teacher's name:	

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Teacher's signature:	
Date:	

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The **student** fills in this section:

I agree with my teacher's description of how I completed this activity Yes ☐	
Use this space to make any extra comments.	
Student's signature:	
Date:	

Guidance notes

Both the teacher **and** the student are responsible for completing this form.

The **teacher must**:
- use the form to describe in detail what they observed the student doing.
- give contextualised details of what the student did and how this relates to the Assessment Criteria.
- say how well the activity was completed in relation to the Assessment Criteria with reasons.
- share what they have written with the student and offer the opportunity to discuss if the student disagrees with what is written.
- reach agreement with the student before the work is submitted for moderation.
- sign and date the form as evidence of agreement.

The **student must**:
- reach agreement with the teacher before the work is submitted for moderation.
- use the form to show that they agree with the teacher's record of the activity observed
- sign and date the form as evidence of agreement.

The form **must**:
- be accompanied by extra evidence, as required by the task.
- provide evidence that is individual to the student.

The form **must not**:
- contain a simple repeat of the Assessment Criteria.
- contain just a list of skills.
- be completed by anyone other than the teacher observing the activity and the student completing the activity.
- be written by the student for the teacher to sign.
- be used to evidence achievement of a whole unit or task in isolation.

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NEA Command Words

The table below shows the command words that may be used in the NEA assignments and/or assessment criteria.

Command Word	Meaning
Adapt	• Change to make suitable for a new use or purpose
Analyse	• Separate or break down information into parts and identify their characteristics or elements • Explain the pros and cons of a topic or argument and make reasoned comments • Explain the impacts of actions using a logical chain of reasoning
Assess	• Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts
Calculate	• Get a numerical answer, showing how it has been worked out
Classify	• Arrange in categories according to shared qualities or characteristics
Compare	• Give an account of the similarities and differences between two or more items, situations or actions
Conclude	• Judge or decide something
Describe	• Give an account that includes all the relevant characteristics, qualities, or events
Discuss (how/whether/etc)	• Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement
Evaluate	• Make a reasoned qualitative judgement considering different factors and using available knowledge/experience
Examine	• To look at, inspect, or scrutinise carefully, or in detail
Explain	• Give reasons for and/or causes of something • Make something clear by describing and/or giving information
Interpret	• Translate information into recognisable form • Convey one's understanding to others, e.g. in a performance
Investigate	• Inquire into (a situation or problem)
Justify	• Give valid reasons for offering an opinion or reaching a conclusion
Research	• Do detailed study in order to discover (new) information or reach a (new) understanding
Summarise	• Express the most important facts or ideas about something in a short and clear form

We might also use other command words but these will be:

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- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

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